

Original Article

Comparison of the Result of Early and Delayed Skin Grafting in Deep Burns of the Hand

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Abstract - Deep hand burns are a common cause of injury leading to long-term morbidity and decreased quality of life. The ideal timing for performing skin grafting is still debated, with no method proving superiority over others. **Objective:** The aim of this study was to evaluate the final outcome of patients undergoing excision and early or late skin grafting. **Materials and Methods:** This prospective comparative analytical study was conducted over a one-year period (2022-2023) at Tishreen University Hospital, Latakia, Syria. The study included a group of patients with deep hand burn defects undergoing reconstruction using skin grafting. Patients were classified into two groups, each consisting of 25 patients: early skin grafting and late skin grafting, with complications compared between the study groups. **Results:** The study included 50 cases, with a male-to-female ratio of 66% and 34%, respectively, and a mean age of 32.11±9.2 years. The majority of patients had second-degree burns (74%), with the most frequent site being the palm of the hand (42%) and hot liquids and flames being the main causative factors for burns. There were no significant differences between the study groups in terms of demographic variables and basic clinical characteristics. The recovery time was significantly longer in the late skin grafting group (26.5±4.8 days vs. 9.2±2.8 days with p:0.0001). There were no significant differences between the study groups in terms of temperature sensation (p:1), vibration (p:1), two-point discrimination (p:0.5), functional movement assessment (p>0.05), and resulting complications, including contracture (p:0.05), scarring (p:0.8), and infection (p:0.1). **Conclusion:** The current study showed that patients treated with early skin grafting had a shorter recovery time advantage, but there were no significant differences between the two groups in terms of complications and functional assessment.

Keywords - Deep burns, Hand, Skin grafting, Early, Late, Complications.

1. Introduction

The skin represents the largest organ in the human body, providing protection against external harmful factors, regulating temperature, and preventing infections.

However, this barrier may be compromised in the event of burns during the first second.

Burns are defined as tissue injuries resulting from various factors such as flames, chemicals, electricity, and sunlight, responsible for approximately 180,000 deaths worldwide annually, according to the World Health Organization estimates.

Burns rank as the fourth most common pattern of injuries after road traffic accidents, falls, and interpersonal violence. Therefore, good education and awareness of the importance of this issue are crucial steps in reducing morbidity and associated deaths, in addition to providing appropriate treatment to improve outcomes, as burns are significant causes

of temporary and permanent disability, especially in children [4,5].

Despite advancements in surgical techniques, burn wounds continue to pose a continuous challenge for reconstructive surgeons. While superficial burns can be managed through debridement and local wound care, deep burns require surgical excision and skin grafting [6]. Routine use of skin grafting has expanded surgeons' ability to achieve successful reconstruction and improve the quality of life for burn patients by addressing various issues, such as scar contracture leading to movement restriction, pain, disfigurement, and social isolation [7,8].

Skin grafts involve harvesting a portion of the skin, which may be partial thickness involving the epidermis and varying portions of the dermis or full thickness encompassing all layers of the skin. The viability of skin grafts depends on the blood supply to the recipient bed, and several patient-related factors (comorbidities, nutritional status) influence the graft



uptake rate. Therefore, surgical planning and appropriate execution in terms of selecting the donor site for skin grafting and choosing the appropriate color and texture of skin are key factors in successful reconstruction along with postoperative physical therapy programs [9,10].

Early healing of burns is essential to reduce complications associated with it, with varied outcomes related to the optimal timing of performing skin grafting in deep hand burns.

There is no consensus on the optimal management of deep hand burns (early surgical excision and grafting versus delayed grafting), and in the absence of high-quality future studies, early excision and grafting within the first 4-6 days are recommended. The assessment of burns should be reassessed repeatedly as burns are a dynamic process, and it is difficult to distinguish partial-thickness burns from full-thickness burns. Hand burns require special attention as the skin on the palm is very thick with excellent healing potential, so palm burns may heal without grafting while avoiding early excision. Structures such as tendons, bones, or joints should not be exposed, and split-thickness skin grafting for hand burns should use donor sites that are uninjured. The function and cosmetic outcome of the hand are crucial in managing hand burns, and sheet grafts are preferred over meshed grafts and can be harvested from the back, scalp, or thigh.

2. Research Significance and Objectives

Approximately 80% of severe burn injuries involve the hand, which is associated with significant morbidity impacting hand function and quality of life. Therefore, achieving early healing of burns is crucial for infection prevention, minimizing complications, and achieving optimal cosmetic results. Skin grafting is one of the most commonly used techniques in reconstructive surgery, with variations in the timing of early or delayed grafting procedures.

2.1. The Main Objective

Evaluate the outcomes of early and delayed skin grafting in deep hand burns from both functional and aesthetic perspectives.

2.2. The Secondary Objectives

- Comparing the healing time between early and delayed grafting.
- Studying the complications resulting from both methods.

2.3. The Research Sample

The research sample consisted of all patients presenting to the reconstructive and cosmetic surgery clinic at Tishreen University Hospital in Lattakia from September 2022 to September 2023.

2.3.1. Inclusion Criteria

Inclusion criteria involved patients with deep burns on the hand requiring skin grafting.

2.3.2. Exclusion Criteria

- Patients with multiple traumatic injuries require intensive care.
- Patients with chronic diseases that hinder skin healing (cardiovascular diseases, diabetes, chronic glucocorticoids therapy).

The study sample was a group of 50 patients at Tishreen University Hospital, Department of Burns and Reconstructive Surgery, over the period of the study.

3. Materials and Methods

3.1. The Research Design

A prospective analytic comparative study

3.2. Place and Duration of the Study

Tishreen University Hospital over the period from September 2022 to September 2023.

Informed consent was obtained from patients for study participation, data collection, and completion of the patient questionnaire.

Detailed patient history was taken, including age, comorbidities, medication history, smoking status, burn location, degree, and cause.

Burn wounds were cleaned with saline solution, appropriate dressings were applied, and appropriate antibiotics were started until skin grafting was performed.

Patients were randomly assigned to two groups: the first group (25) underwent early skin grafting before ten days post-injury, and the second group (25) underwent delayed skin grafting after the tenth day post-injury.

Skin grafts were harvested using a Dermatome device from various areas of the body (lateral face of the thigh, buttocks area, and the clavicle), then the graft was secured onto the burn area after debridement of necrotic layers and application of a compressive dressing for 5 days, with daily follow-up.

Photographic documentation was done for all patients before surgery, post-surgery, and on the fifth day after grafting when dressings were removed.

The final outcomes between the two groups were compared regarding healing time, complications, and functional performance.

Graft success was defined as achieving good graft Uptake after five days of dressing removal, while graft failure was characterized by partial or complete loss of the grafted skin on the recipient bed.

Healing time: was defined as the period required for a wound or burn, regardless of its size or location, to reach a state of physiological and biological stability.

Daily activities were evaluated, including opening a jar, writing or typing, combing hair, washing clothes, and grasping objects using the following scale: 1- no impairment, 2- mild impairment, 3- moderate impairment, 4- severe impairment, 5- total disability.

3.3. The Statistical Methods

This included conducting statistical analysis using the Statistical Package for the Social Sciences (SPSS) software (version 20, IBM Corporation). A significance level of less than 0.05 (P Value < 0.05) was considered statistically significant.

3.3.1. Descriptive Statistics

Categorical variables: relied on frequencies, percentages, and graphical representations.

For continuous variables, measures of central tendency (mean and standard deviation, domain) were used.

The Independent T-student test was employed to compare the means of two independent groups.

The Chi-square test was used to study the relationship between qualitative variables. The section should contain sufficient detail so that all procedures can be repeated. It may be divided into headed subsections if several methods are described.

4. Results and Discussion

4.1. Results

The study sample distribution according to demographic variables:

Included 50 patients from the Burn and Reconstructive Surgery Department at Tishreen University Hospital in Lattakia during the period 2022-2023, meeting the inclusion criteria for the study. There were 33 male cases, accounting for 66%, and 17 female cases, accounting for 34%, with a Sex Ratio (Male: Female) of 1.9:1.

Patients in the study ranged in age from 20 to 58 years, with an average age of 32.11 ± 9.2 years. The burn cases were categorized as follows: Grade II accounted for 37 cases (74%), while Grade III comprised 13 cases (26%). The most common burn site was the palm of the hand, with 21 cases (42%), followed by the back of the hand, with 16 cases (32%), the back, with 9 cases (18%), and fingers with 4 cases (8%). Burns were caused by various factors, with hot fluids being the most common cause in 19 cases (38%), followed by flames in 16

cases (32%), chemicals in 13 cases (26%), and electricity in 2 cases (4%).

Table 1. Demographic characteristics and burning specification for the search group

Characteristics		Number (percentage)
Sex	Male	33 (66%)
	Female	17 (34%)
Age (year)		32.11 ± 9.2
Burn Degree	II	37 (74%)
	III	13 (26%)
Burn Location	The Palm of the Hand	21 (42%)
	Palm and Back of the Hand	16 (32%)
	The Back of the Hand	9 (18%)
	Fingers only	4 (8%)
Burn Causing Factor	Hot Liquids	19 (38%)
	Flame	16 (32%)
	Chemicals	13 (26%)
	Electricity	2 (4%)

The patients were stratified into two cohorts based on the timing of skin grafting: one group comprised 25 individuals who underwent early skin grafting, while the other group consisted of 25 patients who received delayed skin grafting.

Within the early grafting cohort, there were 16 male cases, representing 64% of the group, and 9 female cases, accounting for 36%. In comparison, the delayed grafting group had 68% male and 32% female cases, with no statistically significant variances between the two groups (p: 0.3). The age range of patients in the early grafting group was 20 to 48 years, with a mean of 29.5 ± 7.2 years, while the delayed grafting group had an average age of 31.9 ± 8.3 years, showing no statistically significant differences (p: 0.2).

Regarding burn classification, Grade II burns were observed in 19 cases (76%) and Grade III burns in 6 cases (24%) in the early grafting cohort, compared to 72% and 28%, respectively, in the delayed grafting group, with no statistically significant distinctions (p: 0.9).

In terms of burn location, the early grafting group predominantly experienced burns on the palm of the hand in 11 cases (44%), on both the palm and back of the hand in 9 cases (36%), on the back of the hand in 4 cases (16%), and solely on the fingers in one case (4%).

This distribution differed slightly in the delayed grafting group, with percentages of 40%, 28%, 20%, and 12% for the respective locations, although statistical significance was not observed between the groups (p: 0.08).

No significant differences were noted between the study groups based on the causative factors of burns (p: 0.6), with hot fluids being the primary cause in the early grafting group in 10 cases (40%), followed by flames in 7 cases (28%),

chemicals in 7 cases (28%), and electricity in one case (4%). This distribution was slightly altered in the delayed grafting group, with proportions of 36%, 36%, 24%, and 4%, respectively.

Table 2. Comparison of the demographic characteristics and burning specification for the research group according to grafting time

Variables		Early Grafting (25 Cases)	Late Grafting (25 Cases)	p-Value
Sex	Male	16 (64%)	17 (64%)	0.3
	Female	9 (36%)	8 (32%)	
Age (year)		29.5 ± 7.2	31.9 ± 8.3	0.2
Burn Degree	II	19 (76%)	18 (72%)	0.9
	III	6 (24%)	7 (28%)	
Burn Location	The Palm of the Hand	11 (44%)	10 (40%)	0.08
	Palm and Back of the Hand	9 (36%)	7 (28%)	
	The Back of the Hand	4 (16%)	5 (20%)	
	Fingers only	1 (4%)	3 (12%)	
Burn Causing Factor	Hot Liquids	10 (40%)	9 (36%)	0.6
	Flame	7 (28%)	9 (36%)	
	Chemicals	7 (28%)	6 (24%)	
	Electricity	1 (4%)	1 (4%)	

The healing time ranged from 7-15 days in the early grafting group with a mean duration of 9.2 ± 2.8 days, compared to 26.5 ± 4.8 days in the delayed grafting group, showing statistically significant differences between the two groups (p: 0.0001). Complications occurring in the early grafting group compared to the delayed group included contraction (4% vs. 8%, p: 0.05), scarring (4% vs. 4%, p: 0.8), and infection (4% vs. 0%, p: 0.1).

group, tactile discrimination between two points was normal in 16 cases (64%) and abnormal in 9 cases (36%), compared to 68% and 32% respectively in the delayed grafting group, with no significant differences (p: 0.5).

Evaluation of vibration and temperature sensation was normal in all patients in both treatment groups, with no significant differences observed (p: 1). In the early grafting

The average scores for the ability to open containers, write and type, comb hair, wash clothes, and grasp objects were as follows in the early grafting group: 1.78 ± 1.1, 1.22 ± 0.9, 1.55 ± 1.4, 1.88 ± 1.2, and 1.88 ± 1.2 respectively, compared to 1.61 ± 1.4, 1.61 ± 1.4, 1.39 ± 1.2, 1.79 ± 0.9, and 1.50 ± 0.8 in the delayed grafting group, with no statistically significant differences observed (p>0.05).

Table 3. Comparison of the final outcome of the research group according to grafting time

Variables		Early Grafting (25 Cases)	Late Grafting (25 Cases)	p-Value
Healing Time (day)		9.2 ± 2.8	26.5 ± 4.8	0.0001
Complications	Contraction	1 (4%)	2 (8%)	0.05
	Scarring	1 (4%)	1 (4%)	0.8
	Infection	1 (4%)	0 (0%)	0.1
Vibration- Temperature Sensation	Normal	25 (100%)	25 (100%)	1
	Abnormal	0 (0%)	0 (0%)	
Two-points discrimination	Normal	16 (64%)	17 (68%)	0.5
	Abnormal	9 (36%)	8 (32%)	
Functional movement assessment	Opening a jar	1.78 ± 1.1	1.61 ± 1.4	0.6
	Writing or typing	1.22 ± 0.9	1.29 ± 0.7	0.1
	Combing hair	1.55 ± 1.4	1.39 ± 1.2	0.8
	Washing clothes	1.88 ± 1.2	1.79 ± 0.9	0.2
	Grasping objects	1.63 ± 1.1	1.5 ± 0.8	0.7

5. Discussion

The study was conducted on 50 patients admitted to Tishreen University Hospital in Lattakia over a one-year period (2022-2023) with deep burns on the hand, meeting inclusion criteria for dermatological grafting.

The study revealed the following: The patients in the study had a diverse range of ages, with an average age of 32 years, and males represented approximately two-thirds of the study sample. The higher frequency of males can be attributed to their often working outside the home, frequently in poor working environments with little or no protection. Hot liquids and flames were the most common causes of burns, reflecting the different daily activities individuals engage in.

The majority of burns were second-degree, most frequently occurring in the palm of the hand, followed by the back of the hand. Patients were divided into two groups based on grafting timing: the early grafting group consisting of 25 patients and the delayed grafting group with 25 patients, comparing demographic characteristics and final outcomes between the two groups.

No statistically significant differences were observed between the two groups regarding age, gender, burn severity, location, and causative factor ($p>0.05$), with burns more common in males, predominantly second-degree, extending to the palm of the hand in 40% or more in both groups.

The healing time was significantly longer in the delayed grafting group ($p: 0.0001$). This can be explained by early grafting reducing blood contamination and inflammatory mediators by early removal of burned skin, thereby reducing the risk of infection and not delaying healing progression.

No significant differences were observed between the study groups in terms of complications such as contraction, scarring, and infection ($p>0.05$). However, contraction was more frequent in the delayed grafting group, and only one case of infection developed in the early grafting group.

There were no significant differences statistically between the study groups in terms of evaluating vibration sensation, temperature sensation, two-point discrimination, and functional movement assessment ($p>0.05$). However, the average functional movement assessment score was slightly higher in the early grafting group.

6. Comparison with International Studies

Mohammadi et al. (2011) conducted a research study in Iran spanning a two-year timeframe, involving 50 patients with second and third-degree burns who underwent dermatological grafting either early (25 patients) or delayed (25 patients). The analysis revealed no statistically significant variances between the two cohorts in terms of age, gender

distribution, burn site, and causative factors, with flames being the predominant cause identified.

The mean graft uptake rate was 73 ± 17 in the early grafting group compared to 85 ± 12 in the delayed group, with no significant disparities observed post-reconstruction between the groups concerning scar formation, temperature and vibration sensitivity, two-point discrimination, hand functionality, and specificity in daily activities ($p>0.05$). The average satisfaction scale for limb movement was 2.45 ± 1.1 in the early grafting group and 2.29 ± 0.9 in the delayed grafting group, with a p-value of 0.6.

In comparison to the present study, both investigations concurred on the absence of significant differences between the two groups regarding hand function and complication rates, with a notably shorter healing duration noted in the early grafting cohort. This factor had not been previously explored (Mohamadi et al., 2011).

Badr et al. (2019) conducted a study in Egypt over a one-year period involving 30 patients with deep hand burns undergoing dermatological grafting either early (15 patients) or delayed (15 patients). No statistically significant distinctions were observed between the two groups in terms of age and gender distribution. The average graft uptake rate was significantly higher in the early grafting group (91.33 ± 7.67) compared to the delayed group (83.67 ± 10.8) with a p-value of 0.02. No significant variations were noted between the groups concerning infection development ($p: 0.1$), contraction ($p: 0.2$), and the necessity for subsequent surgical intervention ($p: 0.6$). Significant differences were observed between the groups in terms of itchiness scale (7.6 ± 4.2 in early versus 12.8 ± 4.7 in delayed with $p: 0.002$) and scar formation scale (4.13 ± 1.9 versus 6.8 ± 2.2 with $p: 0.002$).

In contrast to the current study, there were no notable differences in the scar scale, contrary to Mohamadi et al. (2011), where it was higher in the delayed grafting group.

Sharma et al. (2019) conducted a study in India over a one-year period involving a group of patients with deep hand burns undergoing dermatological grafting either early (42 patients) or delayed (42 patients). Burns were more prevalent in males, with flames identified as the primary causative factor. The graft uptake rate was higher in the early grafting group (88.28) compared to the delayed group (82.11), with a significantly shorter healing time in the early group statistically (23.2 days versus 53.2 days in the delayed). The blood transfusion rate was higher in the early grafting group (2.8 units versus 1.4 units), with no significant differences between the groups regarding functional evaluation scale, satisfaction levels, and pain perception ($p>0.05$). In contrast, the average aesthetic evaluation scale was significantly higher in the early group (8.8 in early versus 7.8 in delayed, $p: 0.01$).

In comparison to the current study, both investigations concurred that healing time was notably shorter in the early grafting group. However, they differed regarding differences in the aesthetic evaluation scale, which was higher in the early grafting group, according to Sharma et al. (2019).

7. Conclusion

- Despite the common practice of delayed grafting in most cases of deep hand burns, our study found that the time to healing in cases of early grafting was shorter than in cases of delayed grafting, thereby reducing the occurrence of complications, including infections, without significant differences in functional performance, discrimination between two points, and sensation of vibration and

temperature.

- Therefore, it can be concluded that it is not necessary to wait longer to perform delayed grafting in hand burns, and the option of early grafting can be considered a better therapeutic choice.

Recommendations

Management of deep hand burns can be achieved using either early or delayed grafting with similar outcomes in terms of hand function recovery and associated complication rates.

However, early grafting may be preferred under suitable conditions due to the shorter healing time and consequent reduction in associated costs.

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